



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

PC Code: 128847

DP Barcode: 409484 and 409488

Date: November 8, 2013

MEMORANDUM

Subject: Ecological Risk Assessment for the Proposed New Use of Difenconazole on Canola and Oilseed Subgroup 20A

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This memorandum summarizes the ecological risks associated with the proposed new use of the fungicide difenconazole. The risk assessment considers use of the product Inspire® on canola and oilseed subgroup 20A.

Foliar applications (ground or aerial spray and chemigation) are proposed at 0.113 lb ai/A/crop. It is assumed that there is one crop/year and an annual limit of 0.113 lb ai/A for this use.

The single maximum application rate is similar to previously assessed uses and EECs are lower than those for many previously assessed uses. However, a risk assessment was conducted to incorporate additional toxicity data that has been reviewed since the last risk assessment (D402993, 8/29/2012). The recently reviewed difenconazole studies addressed acute and chronic toxicity to freshwater fish (MRID 48453201 and 48453205), avian acute oral toxicity (MRID 48453202), and terrestrial plant toxicity (MRID 48453203 and 48453204). The major degradate (1,2,4-triazole and triazole acetic acid) studies addressed acute toxicity to freshwater fish (MRID 48474301 and 48453209) and freshwater invertebrates (MRID 48453206 and 48453208).

As in recent risk assessments, total toxic residue (TTR) EECs were used to characterize risk when guideline data were not available for the major degradates (1,2,4-triazole and triazole acetic acid) and toxicity of the degradates was assumed equal to that of difenconazole.

1. Executive Summary

The Environmental Fate and Effects Division (EFED) evaluated the proposed new use of the broad-spectrum fungicide difenoconazole (Inspire[®]) on canola and oilseed subgroup 20A. Difenoconazole is a fungicide in the conazole chemical class. Fungicidal activity of the conazole class is attributed to the inhibition of ergosterol biosynthesis.

A number of risk assessments have been conducted on difenoconazole. Previous assessments identified risk concerns primarily for aquatic invertebrates, fish, birds, and mammals on a chronic basis (on an acute basis for estuarine/marine invertebrates for certain uses). In past assessments, a risk concern was not precluded for terrestrial plants due to lack of acceptable data. Taxonomic groups for which concern levels were exceeded for the proposed use (**Table 1**) are similar to those identified in previous assessments.

Table 1. Potential Effects to Listed Species Associated with the Proposed New Use of Difenoconazole

Listed Taxa	Direct Effects ¹	Indirect Effects
Terrestrial and semi-aquatic plants – monocots and dicots	Yes (listed dicots)	Yes
Birds	No – Acute Yes – Chronic	Yes
Terrestrial-phase amphibians	No – Acute Yes – Chronic	Yes
Reptiles	No – Acute Yes – Chronic	Yes
Mammals	No – Acute Yes – Chronic	Yes
Aquatic plants	No ²	Yes
Freshwater fish	No – Acute Yes – Chronic	Yes
Aquatic-phase amphibians	No – Acute Yes – Chronic	Yes
Freshwater invertebrates	No – Acute No – Chronic	Yes
Estuarine/marine fish	No – Acute Yes – Chronic	Yes
Estuarine/marine invertebrates	No – Acute Yes – Chronic	Yes
Terrestrial invertebrates	No	Yes ³

¹ RQs for aquatic plants and chronic risk to fish and aquatic invertebrates were based on total toxic residues (TTR) due to a lack of guideline toxicity data for 1,2,4-triazole and triazole acetic acid. Degradate toxicity was assumed equal to that of difenoconazole for those endpoints.

² There is some uncertainty for non-vascular plants because an acceptable study with cyanobacteria is not available; however, there are not currently any listed non-vascular plant species.

³ Only for obligate relationships with listed terrestrial plant species (dicots).

2. Data Gaps

Several data gaps remain, as identified in past risk assessments (data unavailable or available data is insufficient). The impact of these data gaps on the risk conclusions varies with the use and application rate of difenoconazole.

- 850.1350 (Estuarine-marine invertebrate life-cycle) – TGAI, difenoconazole
- 850.2100 (Acute oral toxicity to birds) – CGA-71019 (1,2,4-triazole) and CGA-142856 (triazole acetic acid)
- 850.4550 (Cyanobacteria toxicity) – TGAI, difenoconazole
- 850.4100 (Terrestrial plant toxicity, seedling emergence) – TEP
 - Tier II testing is required or a Tier I test can be used if a NOAEC is established at the maximum labeled single application rate. See section 8.1.3 for additional issues with available study.
- 850.4150 (Terrestrial plant toxicity, vegetative vigor) – TEP
 - Tier II testing is required or a Tier I test can be used if a NOAEC is established at the maximum labeled single application rate.
- There is uncertainty associated with chronic risk to benthic invertebrates given that porewater EECs are similar to water column EECs and a lack of acceptable toxicity data for benthic invertebrates. Although a sediment toxicity study (range finding) determining the effects of difenoconazole on benthic organisms has been submitted and reviewed, the numerous deviations in the study limit its use for quantitative purposes. Data is recommended given that the chronic LOC (1.0) is exceeded for aquatic invertebrates based on comparison of water column species toxicity data to porewater EECs.

In addition, a guideline chronic fish study (850.1400) with the major degradates (1,2,4-triazole and triazole acetic acid) would be useful for reducing uncertainty in the risk conclusions.

3. Uncertainties

- The assessment of chronic risk to benthic invertebrates was based on toxicity to water column species due to a lack of data suitable for quantitative risk assessment. Risk conclusions for the proposed use are the same for benthic invertebrates because the pore water EECs are similar to water column EECs; that is, there is a chronic risk concern for estuarine/marine invertebrates but not a risk concern for freshwater invertebrates. The risk concern triggered for water column estuarine/marine species is protective of estuarine/marine invertebrate species in general (i.e., there is a risk concern); however, the magnitude of the RQ associated with that concern is uncertain for both water column invertebrates (non-definitive endpoint) and benthic invertebrates (lack of data). There is more uncertainty in the

risk conclusions for freshwater invertebrates given that benthic species may be more sensitive than water column species.

- There is some uncertainty about risk to aquatic plants because an acceptable study with blue green algae is not available. There are not currently any listed non-vascular plants so the uncertainty is for non-listed species. Blue-green algae would need to be about 33x more sensitive than *Navicula pelliculosa* to exceed the LOC (non-listed species).
- There would not be a chronic risk concern for fish if the degradates are less toxic than difenoconazole (RQ = 0.89 based on a 60-day difenoconazole-only EEC = 0.77 µg/L); therefore, guideline chronic fish studies with the major degradates (1,2,4-triazole and triazole acetic acid) would be useful for refining the risk conclusions if they demonstrate less toxicity than difenoconazole.
- Before difenoconazole breaks down to 1,2,4-triazole, it forms CGA-205375, (1-[2-Chloro-4-(4-chlorophenoxy)-phenyl]-2-[1,2,4]triazol-1-yl-ethanol). CGA-205375 has potential to be slightly more mobile in the soil than difenoconazole based on the registrant-submitted adsorption/desorption study. The potential adverse effect of this degrade on the ecological environment was not addressed in this risk assessment. If this degrade is shown to have potential ecological or human health concerns, additional fate and transport studies may be requested at a later time.
- Because it is persistent, difenoconazole and its degradates may accumulate in soil after repeated use. This repeated or continuous exposure may result in significant risks to non-target organisms, especially birds and mammals.
- This risk assessment only considered the most sensitive of the species evaluated in the registrant-submitted studies. The position of the tested species relative to the distribution of all species' sensitivities to difenoconazole is unknown. Extrapolating the risk conclusions from the most sensitive tested species to non-tested species may either underestimate or overestimate the potential risks to those species.

4. Summary of Proposed Use

Foliar applications (ground or aerial spray and chemigation) are proposed at 0.113 lb ai/A/crop. EFED assumes that there is typically one crop of canola per year on a given field; thus, the annual limit for this use is assumed to be 0.113 lb ai/A.

5. Fate and Transport Summary

Difenoconazole is a fungicide in the conazole chemical class. Fungicidal activity of the conazole class of compounds is attributed to the inhibition of ergosterol biosynthesis¹. Ergosterol, which controls cell membrane permeability, is a critical component in fungal cell membranes². The mechanism of controlling ergosterol biosynthesis is through the disruption of the fungal

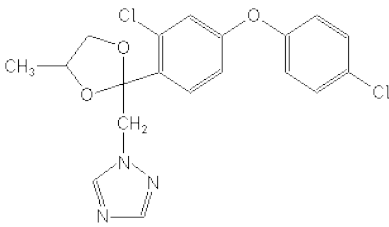
¹ www.centerwatch.com/patient/drugs/dru784.html

² www.hull.ac.uk/php/chsanb/fungweb/fungweb7.htm

cytochrome P-450-mediated 14 α -lanosterol demethylation. Accumulation of 14 α -methyl sterols correlates with the subsequent loss of ergosterol in the fungal cell wall.

Based on a low vapor pressure of 2.5×10^{-10} mm Hg and solubility in water of 15 mg/L, difenoconazole has a low propensity to volatilize and generate vapors after application. At test termination in laboratory studies, the residues detected in an organic volatiles trap totaled 0.7% or less; most instances were less than 0.1% of the applied difenoconazole. The concentrations of the applied difenoconazole lost through volatilization were not measured in the terrestrial field dissipation studies. Selected physical and chemical properties are presented in **Table 2**.

Table 2. Physical and Chemical Properties of Difenoconazole

Property	Value	Source
Common Name	Difenoconazole	MRID 469501-04
CAS Registry No.	119446-68-3	
PC Code	128847	
Structure		MRID 469501-04
Chemical Name (CAS)	1-{2-[4-(chlorophenoxy)-2-chlorophenyl-(4-methyl -1,3-dioxolan-2-yl)-methyl]} -1H-1,2,4-triazole	MRID 469501-04
SMILES notation	<chem>O1CC(C)OC1(Cn2ncnc2)c3c(Cl)cc(Oc4ccc(Cl)cc4)cc3</chem>	EPI Suite, v3.12 SMILES
Molecular Formula	$C_{19}H_{17}Cl_2N_3O_3$	MRID 469501-04
Molecular Weight	406.27	MRID 469501-04
Physical State	Red Liquid	
Vapor pressure	2.5×10^{-10} mm Hg (25 °C)	MRID 465159-01
Henry's Law constant	8.9×10^{-12} atm x m ³ /mol	MRID 465159-01
Specific Gravity/ Density	1.14g/cm ³ @ 25 °C	MRID 469501-04
Solubility in water	15.0 mg/L @ 25 °C	MRID 469501-04
log K _{ow}	4.4 (25 °C)	MRID 469501-05

In soil, difenoconazole is persistent and slightly mobile. Difenoconazole has low potential to reach groundwater, except in soils of high sand and low organic matter content. During a runoff event, difenoconazole will potentially enter adjacent bodies of surface water. In an aquatic

environment, difenoconazole's main route of dissipation is partitioning into the bottom sediment as shown in an aerobic aquatic metabolism study (MRID 42245134), in which the distribution ratio of sediment and water phases was 8:1 at 1 day post-treatment and 40:1 at 30 days post-treatment. Difenoconazole has the potential to undergo slow to relatively fast aqueous photolysis in clear water. **Table 3** summarizes the environmental fate data of difenoconazole. Additional environmental fate data, including major degradates and maximum percent formation can be found in a previous assessment (DP377719, 7/20/2010).

Table 3. Summary of the Environmental Fate Properties of Difenoconazole

Property	Value	Source
Name	Difenoconazole	
Henry's Law constant	8.9×10^{-12} atm x m ³ /mol	MRID 465159-01
Soil adsorption coefficient K _{oc} (L/kg)	3867, 3518, 3471, and 7734 3870, 4587, 4799, and 11202	MRID 422451-35 ^A MRID 469501-21
Hydrolysis half-life pH = 5 pH = 7 pH = 9	Stable Stable Stable	MRID 422451-27
Photolysis half-life in water	6 days – ca. 1 ppm in sterile buffer solution (30-day study) ca. 9.2 days – 1mg ai/L in natural water 228 days – 1.52 ml ai/L in sterile buffer solution (15-day study)	MRID 422451-28 MRID 469501-04 MRID 469501-05 ^B
Photolysis half-life in soil	349 - 823 days	MRID 469501-06 ^C
Aerobic soil metabolism half-life	84.5 days – at 0.1 ppm concentration 1600 days – at 10 ppm in loam 1059 days – at 10 ppm in sandy loam 120 days – at 0.13 ppm; Swiss loam 104 days – at 0.13 ppm; Swiss loam 165 (158) days – at 0.23 ppm; Swiss sandy loam 204 (187) days – at 0.23 ppm; Swiss sandy loam/loamy sand 204 (198) days – at 0.23 ppm; French silty clay loam 433 (408) days – at ca. 0.1 ppm in CA loamy sand at 25 °C 533 days – at ca. 0.1 ppm in CA loamy sand at 25 °C	MRID 422451-31 MRID 422451-32 ^D MRID 422451-33 ^D MRID 469501-09 MRID 469501-10 MRID 469501-11 MRID 469501-12 MRID 469501-14
Anaerobic soil metabolism half-life	947 days – at 10 ppm in loam	MRID 422451-32
Aerobic aquatic metabolism half-life	860 days (10 mg ai/L) 315 (330) days (nominal 0.1 kg ai/ha = 0.17 mg ai/L); Swiss pond water-silty clay loam sediment) 335 (301) days (0.17 mg ai/L; Swiss river water-sandy loam sediment) 565 days (0.04 mg ai/L)	MRID 422451-34 ^E MRID 469501-16 MRID 469501-17
Anaerobic aquatic metabolism half-life	1245 days (10mg ai/L) 370 days (433) (0.04 mg ai/L)	MRID 422451-34 ^E MRID 469501-19

Property	Value	Source
Terrestrial field dissipation half-life	252 days - determined in the 0- to 3-inch depth – CA bare loamy sand 231 days – GA bare loamy sand (four applications of 0.13 lb ai/A) 139 days – CA bare plot of loam soil (four applications of 0.13 lb ai/A) 462 days – ND bare sandy clay loam	MRID 422451-40 MRID 469501-26 MRID 469501-27 MRID 469501-29
Laboratory accumulation in fish bioaccumulation factor (<i>Lepomis macrochirus</i>)	170x in edible tissues 570x nonedible tissues 330x for whole body	MRID 422451-42
a depuration half-life	1 day	
<p>^A There was another adsorption/desorption study (MRID 422451-36) reviewed in which the test soils were autoclaved prior to conducting the study which could distort the mobility characteristic of difenoconazole, thus, the study results were not used for calculation of modeling input parameters.</p> <p>^B For modeling purposes, the longest half-life was used as it represents the most conservative scenario. However, there is considerable uncertainty in the photolysis half-lives because the duration of the studies was considerably shorter than the extrapolated half-life (MRIDs 469501-05 and 469501-06).</p> <p>^C The soil photolysis half-life under xenon light condition was recalculated to represent the conditions under natural sunlight intensity during 30-day periods between June and September (104.7-246.9 W·min/cm²), as a result, a range of half-lives was obtained.</p> <p>^D In those aerobic soil metabolism studies (MRID 422451-32 and MRID 422451-33) the test application rate was significantly higher than expected under registrant-proposed use condition for difenoconazole.</p> <p>^E In those aquatic metabolism studies, the test application rates were significantly higher than expected under registrant-proposed use condition for difenoconazole.</p>		

6. Exposure Summary

6.1 Terrestrial Exposure

EECs were calculated based on the maximum single application rate (0.113 lb ai/A). EECs were calculated in T-REX (v 1.5.2)³ (Table 4) and TerrPlant (v 1.2.2)³ (Appendix 1).

Table 4. Terrestrial Food-Item Residue Estimates for Mammals and Birds for Proposed Foliar Applications of Difenoconazole

Size Class (grams)	Dietary and Dose-Based EECs ¹				
	Short Grass	Tall Grass	Broadleaf Plants	Fruits/Pods/Seeds	Arthropods
Mammals					
Dose-Based EECs					
15	25.86	11.85	14.54	1.62	10.13
35	17.87	8.19	10.05	1.12	6.99
1000	4.14	1.90	2.33	0.26	1.62
Dietary-Based EECs²					
NA	27.12	12.43	15.26	1.7	10.62

³ www.epa.gov/oppefed1/models/terrestrial/index.htm

Size Class (grams)	Dietary and Dose-Based EECs ¹				
	Short Grass	Tall Grass	Broadleaf Plants	Fruits/Pods/Seeds	Arthropods
Avian					
Dose-Based EECs					
20	30.89	14.16	17.37	1.93	12.10
100	17.61	8.07	9.91	1.10	6.90
1000	7.89	3.61	4.44	0.49	3.09
Dietary-Based EECs²					
NA	27.12	12.43	15.26	1.7	10.62

¹ 0.113 lb ai/A

² Size class not used for dietary EECs

6.2 Aquatic Exposure

The Tier II aquatic assessment was performed using PRZM (v3.12.2)/EXAMS (v. 2.98.04.06) modeling with the standard pond scenario. Detailed descriptions of these models can be found in a previous assessment (DP377719, 7/20/2010). Separate EECs were calculated for difenoconazole and its total toxic residues (TTR). Difenoconazole-only EECs were used to assess risk when data were available that indicated that the major degradates were less toxic than difenoconazole (acute risk to fish and invertebrates). This approach is different than that used in recent risk assessments (DP377719, 7/20/2010 and DP378927+, 2/22/2011) which calculated TTR EECs for characterization of acute risk to fish and invertebrates due to a lack of toxicity data at that time. As in those previous assessments, TTR EECs were used to characterize risk when guideline data were not available for the major degradates (aquatic plants and chronic risk to fish and invertebrates).

6.2.1 Exposure Estimates for Difenoconazole

The PRZM/EXAMS input parameters for difenoconazole are shown in **Table 5**. Inputs are equivalent to those used in previous assessments (e.g., DP377719, 7/20/2010). Results of the PRZM/EXAMS modeling are in **Table 6**. The PRZM/EXAMS outputs are included in **Appendix 2**.

Table 5. PRZM/EXAMS Chemical Specific Input Parameters for Difenoconazole

Parameter	Input Value and Unit	Source/Comments
Scenario	ND Canola STD	Only ND Canola Scenario is available for this use
Maximum single application rate Foliar Application	0.113 lbs ai/A (0.127 kg ai/ha)	Inspire Label (EPA Reg. No. 100-1262),
Method of application CAM = 2	Foliar Spray	Product Label as above
Maximum number of applications	1(Foliar)	Product Label as above

Parameter	Input Value and Unit	Source/Comments
Application efficiency	0.99 (Ground Spray) 0.95 (Aerial Spray)	No chemigation scenario was modeled but assumed similar to ground application. EFED Model Input Guidance, Version 2.1 (2009b) ^a
Spray drift	0.01 (Ground Spray) 0.05 (Aerial Spray)	EFED Model Input Guidance, Version 2.1 (2009b)
Application date and minimum interval between applications (days)	July 18 th	---
Henry's Law constant	8.9×10^{-12} atm x m ³ /mol	MRID 46515901
Hydrolysis	Stable	MRID 42245127
Aerobic soil metabolism (t _{1/2}) ^b	313 days	MRIDs: 42245131, 46950109-12, and 46950114
Aerobic aquatic metabolism (t _{1/2}) ^c	556 days	MRIDs: 46950116 & 46950117
Anaerobic aquatic metabolism (t _{1/2}) ^d	1110 days	MRID 46950119
Aquatic photolysis t _{1/2} (days) ^e	Stable	MRID 46950105
Vapor pressure	2.5×10^{-10} mm Hg (25 °C)	MRID 46515901
Solubility in water	15 mg/L (25 °C)	MRID 46515901
Molecular Weight	406.27	MRID 46950104
Partition coefficient K _{oc}	5381 mL/g	MRIDs: 42245135 and 46950121
^a <i>Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides</i> (Version 2.1; Oct. 22, 2009)		
^b The 90% of the UCL of the mean metabolism half-life.		
^c The 90% of the UCL of the mean metabolism half-life of all available half-lives but those obtained for high test rate.		
^d At proposed application rate only one half-life was available, the half-life was multiplied by three (i.e., 3 x 370 days).		
^e Estimated half-life is beyond the duration of study, thus considered stable.		

Table 6. Estimated Environmental Concentrations (EECs) of Difenoconazole for Surface Water Based on Selected Crop Scenarios

Water Source (model)	Use Scenario (rate and interval)	Application Method	Peak EEC (µg/L)	21-Day EEC (µg/L)	60-Day EEC (µg/L)
Concentrations (EECs) of Difenoconazole only					
Surface Water (PRZM/EXAMS)	ND Canola STD (1 application @ 0.113 lb ai/A)	Aerial	1.00	0.83	0.77
		Ground	0.57	0.49	0.45
Concentrations (EECs) of Total Toxic Residues (Difenoconazole and Its Degradates)					
Surface Water (GENEEC)	ND Canola STD (1 application @ 0.113 lb ai/A)	Aerial	3.03	2.95	2.80
		Ground	2.74	2.67	2.53

6.2.2 Exposure Estimates for the Total Toxic Residues of Difenoconazole

Difenoconazole and its major degradates (1,2,4-triazole and its conjugates triazole alanine and triazole acetic acid), are assumed to be persistent in the environment with a low soil partition coefficient in all modeled media. In general, for persistent chemicals, yearly EECs of

PRZM/EXAMS are not independent and are correlated to the previous year's concentration in PRZM/EXAMS output. Therefore, the GENEEC model was used to estimate EECs for TTR (difenoconazole + 1,2,4-triazole + triazole acetic acid) to characterize potential effects on aquatic organisms. For the TTR GENEEC modeling, all input parameters were the same as listed in **Table 5** with the exception of the photolysis half-life, the aerobic soil metabolism half-life, and the aerobic and anaerobic aquatic metabolism half-lives which were assumed to be zero (stable). A soil partition coefficient (Koc) of 1000 mg/L was also assumed for the total toxic residues. The TTR EECs for the proposed canola use are listed in **Table 6**. The GENEEC output file is located in **Appendix 2**.

6.2.3 Monitoring Data

The U.S. Geological Survey's National Water Quality Assessment program (NAWQA) has conducted some monitoring for difenoconazole.⁴ Twelve surface water and sediment samples collected in California and Georgia were analyzed for difenoconazole. Difenoconazole was detected in only one of twelve surface water samples; the reported maximum concentration (18.2 ng/L) was detected in California. Difenoconazole was not detected in sediment samples (limit of quantitation (LOQ) was 0.6 µg/kg-sediment). NAWQA monitoring data were not targeted specifically to difenoconazole use areas or during times of known difenoconazole use; thus, the dataset may not reflect peak difenoconazole concentrations that may occur in surface waters when runoff events occur shortly after difenoconazole is applied.

Monitoring data for surface water, groundwater, and sediment from the California Department of Pesticide Regulation (CDPR) were searched on October 23, 2013⁵. Difenoconazole monitoring data were not available.

7. Ecological Effects Summary

Toxicity data are summarized in **Tables 7, 8, 9, and 10** (for details see D377719, 7/20/2010). Additional toxicity data has been reviewed since the last risk assessment (D402993, 8/29/2012), is briefly summarized below, and is incorporated into the summary tables below as applicable. The recently reviewed difenoconazole studies addressed acute and chronic toxicity to freshwater fish (MRID 48453201 and 48453205), avian acute oral toxicity (MRID 48453202), and terrestrial plant toxicity (MRID 48453203 and 48453204). The 1,2,4-triazole studies addressed acute toxicity to freshwater fish (MRID 48474301) and freshwater invertebrates (MRID 48453206). The triazole acetic acid studies addressed acute toxicity to freshwater fish (MRID 48453209) and freshwater invertebrates (MRID 48453208). The available studies with 1,2,4-triazole and triazole acetic acid indicate that they are less acutely toxic than difenoconazole to freshwater fish and invertebrates.

The acute oral toxicity of difenoconazole to canary study (MRID 48453202) was a limit test resulting in an LD₅₀ > 2000 mg ai/kg bw. A single mortality was observed at the treatment rate; however, it was unclear if the death was treatment related or due solely to the observed abnormal heart function in that bird. No other effects were noted. The study is acceptable.

⁴ <http://water.usgs.gov/nawqa/pnsp/>

⁵ <http://www.cdpr.ca.gov/docs/emon/ehap.htm>

The 96-hr LC₅₀ for fathead minnow was 1.8 mg ai/L (MRID 48453201). Sublethal effects (lethargy, loss of equilibrium, lying on the bottom, and floating at the surface) were observed at treatment concentrations 1.3 mg ai/L and higher. The observed NOAEC was 0.66 mg ai/L. The study is acceptable.

The freshwater fish (fathead minnow) life cycle study (MRID 48453205) resulted in a NOAEC = 1.9 µg ai/L. The LOAEC was 3.7 µg ai/L based on reduced male length of the F0-generation 12 weeks post-hatch. Additional endpoints were effected at higher test concentrations: F0 generation length at 4 weeks, 8 weeks, and 12 weeks (female); F0 generation weight at 12 weeks (male and female); and F1 generation length at 8 weeks. This study is acceptable.

An acute-to-chronic ratio (ACR) of fathead minnow toxicity data (MRID 48453201 and 48453205) was used to estimate chronic toxicity to rainbow trout because rainbow trout was the most sensitive species on an acute basis. Likewise, an ACR was used with fathead minnow data (acute and chronic) and sheepshead minnow data (acute) to estimate chronic toxicity to marine/estuarine fish.

The recently submitted terrestrial plant studies (MRID 48453203 and 48453204) showed no statistically significant effects at the limit test concentration (0.111/0.112 lb ai/A for seedling emergence and 0.123 lb ai/A for vegetative vigor). However, in the seedling emergence study, the lack of statistical significance for three of the dicots (lettuce, soybean, and sugar beet) may have been due to high experimental variability and the magnitude of some of the effects is considered potentially biologically significant. Lettuce showed reduced emergence (21%), survival (17%), shoot length (26%), and dry weight (24%). Soybean showed reduced shoot length (23%). Sugar beet showed reduced survival (18%). Additionally, there was poor emergence (63%) of the sugar beet control seeds; seedlings did not meet the minimum acceptable USDA control germination standard for this species (70%). These studies are supplemental because the limit test concentration is below the maximum labeled single rate (currently 0.26 lb ai/A, golf course turf).

Table 7. Summary of Most Sensitive Aquatic Toxicity Endpoints for Difenconazole

Type of Study	Species	Toxicity Value (µg ai/L)	MRID
Acute – Freshwater Fish	Rainbow trout (<i>Oncorhynchus mykiss</i>)	96-hr LC ₅₀ = 810	42245107
Chronic – Freshwater Fish	Fathead minnow (<i>Pimephales promelas</i>)	NOAEC = 1.9 LOAEC = 3.7 based on reduced male length of F0-generation 12 weeks post-hatch	48453205
	Rainbow trout (<i>Oncorhynchus mykiss</i>)	NOAEC = 0.86 Value used for risk assessment. Based on acute-to-chronic ratio of fathead minnow data to rainbow trout data (the most acutely sensitive species). ¹	-
Acute – Freshwater Invertebrate	Water flea (<i>Daphnia magna</i>)	48-hr EC ₅₀ = 770	42245110

Type of Study	Species	Toxicity Value ($\mu\text{g ai/L}$)	MRID
Chronic – Freshwater Invertebrate	Water flea (<i>Daphnia magna</i>)	NOAEC = 5.6 LOAEC = 13.0 based on reduced number of young/adult/reproductive day and adult length	42245114
Chronic – Freshwater Invertebrate (Sediment)	Midge (<i>Chironomus riparius</i>)	EC ₅₀ >50 mg ai/kg-sediment (nominal) NOAEC = 5 mg ai/kg-sediment (nominal) based on emergence rate & development rate	47648601
Acute – Estuarine/Marine Fish	Sheepshead minnow (<i>Cyprinodon variegates</i>)	96-hr LC ₅₀ = 819	42245112
Chronic – Estuarine/Marine Fish	Sheepshead minnow (<i>Cyprinodon variegates</i>)	NOAEC = 0.86 Based on acute-to-chronic ratio of fathead minnow data to sheepshead minnow data. ¹	-
Acute – Estuarine/Marine Mollusk	Eastern oyster (<i>Crassostrea virginica</i>)	96-hr EC ₅₀ = 424	42906701
Acute – Estuarine/Marine Invertebrate	Mysid shrimp (<i>Americamysis bahia</i>)	96-hr LC ₅₀ = 150	42245111
Chronic – Estuarine/Marine Invertebrate	Mysid shrimp (<i>Americamysis bahia</i>)	NOAEC < 0.115 LOAEC = 0.115 based on reduced number of young/adult/reproductive day	46950133
Vascular Plant – Freshwater	Duckweed (<i>Lemna gibba</i>)	EC ₅₀ = 1900 EC ₀₅ = 110 NOAEC < 110 LOAEC = 100 based on reduced frond number	46920504
Non-vascular Plant – Freshwater	Diatom (<i>Navicula pelliculosa</i>)	EC ₅₀ = 98 NOAEC = 53 LOAEC = 150 based on reduced cell density	46920508

¹ Acute toxicity to fathead minnow: LC₅₀ = 1800 $\mu\text{g ai/L}$ (MRID 48453201)

Table 8. Summary of Most Sensitive Terrestrial Toxicity Endpoints for Difenconazole

Type of Study	Species	Toxicity Value	MRID
Acute – Avian Oral Dose	Canary (<i>Serinus canaria</i>)	LD ₅₀ > 2000 mg ai/kg-bw	48453202
Acute – Avian Dietary	Bobwhite quail (<i>Colinus virginianus</i>)	LC ₅₀ = 4579 mg ai/kg-diet	42245103
Chronic – Avian Dietary	Bobwhite quail (<i>Colinus virginianus</i>)	NOAEC = 21.9 mg ai/kg-diet LOAEC = 108 mg ai/kg-diet based on reduction in hatchling body weight	46950202
Acute – Mammalian Oral Dose	Laboratory rat (<i>Rattus norvegicus</i>)	LD ₅₀ = 1453 mg ai/kg-bw	42090006
Two Generation Reproduction – Mammalian	Laboratory rat (<i>Rattus norvegicus</i>)	NOAEC = 25 mg ai/kg-diet LOAEC = 250 mg ai/kg-diet	42090018
Acute – Contact	Honey bee (<i>Apis mellifera</i>)	LD ₅₀ >100 $\mu\text{g ai/bee}$	42245124
Acute – Contact	Earthworm	LC ₅₀ > 610 mg ai/kg-dw	42245125

Type of Study	Species	Toxicity Value	MRID
Terrestrial Plants	Corn, Onion, Ryegrass, Wheat, Radish, Cabbage, Lettuce, Sugar beet, Soybean, and Tomato	Seedling Emergence EC ₂₅ > 0.111/0.112 lb ai/A ¹ NOAEC ≥ 0.111/0.112 lb ai/A ^{1,2}	48453203
		Vegetative Vigor EC ₂₅ > 0.123 lb ai/A NOAEC ≥ 0.123 lb ai/A	48453204

¹ Some species were exposed to 0.111 lb ai/A and others were exposed to 0.112 lb ai/A.

² Effects at 0.11 lb ai/A on lettuce, sugar beet, and soybean were considered biologically significant. Lettuce showed reduced emergence (21%), survival (17%), shoot length (26%), and dry weight (24%). Soybean showed reduced shoot length (23%). Sugar beet showed reduced survival (18%).

1,2,4-triazole

The recently reviewed studies with 1,2,4-triazole indicate that it is less acutely toxic than difenoconazole to freshwater fish and invertebrates. Both studies are acceptable. The 96-hr LC₅₀ = 498 mg ai/L for rainbow trout (MRID 48474301). Sublethal effects (swimming behavior, loss of equilibrium, respiratory function, and pigmentation) were observed in treatment groups ≥ 132 mg ai/L. The 48-hr EC₅₀ > 98.1 mg ai/L for daphnia (MRID 48453206); no mortality or sublethal effects were reported.

A supplemental study (MRID 45880405) evaluated the effects of 1,2,4-triazole on the growth of juvenile rainbow trout (*Oncorhynchus mykiss*). This 28-day study yielded an LC₅₀ > 100 mg/L. Growth was not affected at concentrations up to 100 mg/L. However, significant sublethal effects were observed; from day 23 to day 28, three to five fish were observed to be inactive or have abnormally low activity, to have labored respiration, and to be lying inactive at the bottom of the aquarium in each of the 10, 32, and 100 mg/L test concentrations. The NOAEC for these sublethal effects was 3.2 mg/L. The data are not comparable to early life stage (ELS) studies submitted on difenoconazole. ELS studies are designed to examine effects such as hatching success and larval survival in addition to growth of early life stages. ELS studies may or may not show greater toxicity than juvenile growth studies.

A registrant submitted data summary (MRID 45342701) presented data from several submitted studies including data on birds (MRID 45284015), earthworms (MRID 45297201), daphnids (MRID 00133381), fish (MRID 45284017), and algae (MRID 00133382). The data suggest that 1,2,4-triazole may be less toxic than difenoconazole to fish, daphnids, and aquatic plants, but more toxic to earthworms. However, these studies were typically non-GLP compliant studies or journal articles and are not considered to be reliable to make definitive conclusions regarding the toxicity of 1,2,4-triazole. In some cases, the available study reports are not legible or the study designs were markedly different than guideline protocols such that they provided little useful information. Therefore, these data are not used in the risk assessment.

Ecological Structure Activity Relationship (ECOSAR) methods⁶ were used to predict 1,2,4-triazole toxicity to aquatic non-vascular plants and chronic toxicity to fish and invertebrates based on its structural similarity to chemicals for which aquatic toxicity data are known. A

⁶ ECOSAR predictive software is available publically through the Epi Suite™ program.
<http://www.epa.gov/oppt/exposure/pubs/episuite.htm>

comparison of 1,2,4-triazole ECOSAR estimates to experimentally derived difenoconazole toxicity endpoints suggests that 1,2,4-triazole is not more toxic than difenoconazole to aquatic non-vascular plants, fish (chronic basis), or aquatic freshwater invertebrates (chronic basis). There is a reasonable confidence in the ECOSAR estimates (at least for fish) given that the ECOSAR estimate of acute toxicity to fish is similar to toxicity observed in available studies.

Table 9. Summary of Most Sensitive Aquatic Toxicity Endpoints for 1,2,4-Triazole

Type of Study	Species	Toxicity Value ($\mu\text{g ai/L}$)	MRID
Acute – Freshwater Fish	Rainbow trout (<i>Oncorhynchus mykiss</i>)	96-hr $\text{LC}_{50} = 498,000$	48474301
Acute – Freshwater Invertebrate	Water flea (<i>Daphnia magna</i>)	48-hr $\text{EC}_{50} > 98,100$	48453206

Triazole Acetic Acid

The recently reviewed studies with triazole acetic acid indicate that it is less acutely toxic than difenoconazole to freshwater fish and invertebrates. Both studies are acceptable. The 96-hr $\text{LC}_{50} > 101 \text{ mg ai/L}$ for rainbow trout (MRID 48453209); no mortality or sublethal effects were reported. The 48-hr $\text{EC}_{50} > 108 \text{ mg ai/L}$ for daphnia (MRID 48453208); no mortality or sublethal effects were reported.

A comparison of triazole acetic acid ECOSAR estimates to experimentally derived difenoconazole toxicity endpoints suggests that triazole acetic acid is not more toxic than difenoconazole to aquatic non-vascular plants, fish (chronic basis), or aquatic freshwater invertebrates (chronic basis). There is no basis for judging confidence in the ECOSAR estimates because the ECOSAR estimates for acute toxicity to fish and invertebrates are substantially greater (less toxic) than the non-definitive endpoints observed in the available acute toxicity studies.

Table 10. Summary of Most Sensitive Aquatic Toxicity Endpoints for Triazole Acetic Acid

Type of Study	Species	Toxicity Value ($\mu\text{g ai/L}$)	MRID
Acute – Freshwater Fish	Rainbow trout (<i>Oncorhynchus mykiss</i>)	96-hr $\text{LC}_{50} > 101,000$	48453209
Acute – Freshwater Invertebrate	Water flea (<i>Daphnia magna</i>)	48-hr $\text{EC}_{50} > 108,000$	48453208

7.1 Incidents

Reviews were conducted of the Ecological Incident Information System (EIIS, version 2.1.1)⁷, the Agency's Aggregated Incidents Reports database, and the Avian Incident Monitoring System (AIMS)⁸ on October 28, 2013. No incidents were reported in EIIS or AIMS. Ten minor plant damage incidents were reported for one difenoconazole product (Revus Top) in the aggregated incident database. The Revus Top label indicates that it is a dual ai product containing

⁷ <http://www.epa.gov/espp/consultation/ecorisk-overview.pdf>

⁸ <http://www.abcbirds.org/abcpprograms/policy/toxins/aims/aims/index.cfm>

mandipropamid as well as difenoconazole. No incidents were reported for the proposed product (Inspire[®]) which does not contain mandipropamid.

8. Ecological Risks Summary

8.1 *Potential Risks of Difenoconazole Exposure to Terrestrial Organisms*

The calculated EECs account for 1,2,4-triazole and triazole acetic acid because the proposed use is for a single application. If the degradates are substantially more toxic than difenoconazole then this risk assessment could underestimate potential risks.

8.1.1 *Birds*

There is not an acute risk concern for birds from the proposed use. The acute listed LOC (0.1) was not exceeded on an acute dietary basis (RQs < 0.01). Acute dose-based RQs were not calculated because the available studies resulted in non-definitive endpoints. However, a conservative comparison can be made between the EEC and the highest concentration tested in the toxicity studies. EECs are less than 1/10th of the highest dose tested in these studies (i.e., size-class adjusted LD₅₀); therefore acute dose-based risk is expected to be low from the proposed use.

The chronic LOC (1.0) was exceeded for birds consuming short grass (RQ = 1.24) but not any other food items (**Table 11**). The chronic risk concern assumes that birds consume 100% of their diet as short grass. There is a chronic risk concern for birds (listed and non-listed species) from the proposed use.

Table 11. Summary of Avian Acute and Chronic Risk Quotients for Proposed Difenoconazole Foliar Spray Applications

Feeding Category	Acute Dietary-based RQs	Chronic Dietary-based RQs
Short grass	<0.01	1.24
Tall grass	<0.01	0.57
Broadleaf plants/small insects	<0.01	0.70
Fruits/pods/seeds/large insects	<0.01	0.08
Arthropods	<0.01	0.49

BOLD exceeds chronic LOC (1.0).

8.1.2 *Mammals*

There is not an acute risk concern for mammals from the proposed use (RQs < 0.01). The chronic LOC (1.0) was exceeded for all mammal size-classes consuming short grass, tall grass, broadleaf plants/small insects, and arthropods (**Table 12**). Chronic dietary-based RQs exceed the LOC for mammals consuming short grass. There is a chronic risk concern for mammals (listed and non-listed species) from the proposed use.

Table 12. Summary of Mammalian Acute and Chronic Risk Quotients for Proposed Difenconazole Foliar Spray Applications

Risk Quotients Based on Kenaga Upper Bound EEC	Dose-Based RQs						Chronic Dietary-Based RQs
	15 g		35 g		1000 g		
	Acute	Chronic	Acute	Chronic	Acute	Chronic	
Short grass	<0.01	9.41	<0.01	8.04	<0.01	4.31	1.08
Tall grass	<0.01	4.31	<0.01	3.68	<0.01	1.98	0.50
Broadleaf plants/small insects	<0.01	5.29	<0.01	4.52	<0.01	2.42	0.61
Fruits/pods/seeds/lg insects	<0.01	0.59	<0.01	0.50	<0.01	0.27	0.07
Arthropods	<0.01	3.69	<0.01	3.15	<0.01	1.69	0.42

BOLD exceeds chronic LOC (1.0).

8.1.3 Terrestrial Plants

The LOC (1.0) was not exceeded for monocots (non-listed or listed species) located in dry or semi-aquatic locations (RQs < 0.1) or from spray drift (RQs = 0.25). There is uncertainty regarding the toxicity to dicots even though no statistical significance was detected in the seedling emergence study. The lack of statistical significance for three of the dicots (lettuce, soybean, and sugar beet) may have been due to the high experimental variability and the magnitude of some of the effects is considered potentially biologically significant. Lettuce showed reduced emergence (21%), survival (17%), shoot length (26%), and dry weight (24%). Soybean showed reduced shoot length (23%). Sugar beet showed reduced survival (18%). There is not a risk concern for non-listed dicots assuming that the $EC_{25} = 0.111/0.112$ lb ai/A (the test concentration⁹); this may be a reasonable assumption given that the maximum observed effect was 26%. Risk to listed dicot species cannot be precluded given the magnitude of the observed inhibition at 0.111 lb ai/A for lettuce, soybean, and sugar beet. The NOAEC would need to be about four times lower than 0.111 lb ai/A for a risk concern to semi-aquatic listed dicots. Tier II testing of lettuce, soybean, and sugar beet would reduce uncertainty for listed dicot species. At this time, a risk concern cannot be precluded for listed dicots. There is not a risk concern for monocots from the proposed use.

8.1.4 Terrestrial Invertebrates

There is not an acute contact risk concern for bees from the proposed use. The acute contact-based RQ was not calculated because the available study resulted in a non-definitive endpoint. However, a conservative comparison can be made between the EEC and the highest concentration tested in the toxicity study. The EEC (0.3051 µg ai/bee)¹⁰ is less than 1/2.5¹¹ of the non-definitive LD₅₀ (>100 µg ai/bee).

Acute contact testing of difenoconazole on earthworms resulted in an LC₅₀ greater than 610 mg ai/kg-dw of substrate, as survival was >95% in all treatment groups. No significant differences were detected in any treatment groups relative to the negative control for survival or weight change. The NOAEC and LOAEC were 610 and > 610 mg ai/kg-dw of substrate based on

⁹ Some species were exposed to 0.111 lb ai/A and others were exposed to 0.112 lb ai/A.

¹⁰ The EEC = 0.113 lb ai/A * 2.7 µg ai/bee per lb ai/A = 0.3051 µg ai/bee

¹¹ The LOC for bees is 0.4

survival and weight change. A previous assessment presented an EEC in soil of 0.28 mg/kg-dry soil for use on ornamentals (0.56 lb ai/A/season) which is over three orders of magnitude below the earthworm NOAEC; therefore, there was not a risk concern (see previous assessment for calculations; DP333319, 7/12/ 2007). There is no risk concern for earthworms from the proposed use given that the proposed application rate is lower than the seasonal application rate for ornamentals.

8.2 *Potential Risks of Difenoconazole Exposure to Aquatic Organisms*

Assessment of acute risk to fish and invertebrates was based on difenoconazole EECs because available data indicate that 1,2,4-triazole and triazole acetic acid are less acutely toxic than difenoconazole.

TTR (difenoconazole + 1,2,4-triazole + triazole acetic acid) EECs were calculated for other endpoints due to a lack of guideline toxicity data. This risk assessment may over or underestimate potential risk given the lack of toxicity data. 1,2,4-triazole and triazole acetic acid are assumed equal in toxicity to difenoconazole in the absence of data.

8.2.1 *Fish*

There is not an acute risk concern for fish from the proposed use. The acute listed-species LOC (0.05) was not exceeded for freshwater or estuarine/marine fish (RQs < 0.01).

The chronic LOC (1.0) was exceeded for freshwater and estuarine/marine fish (RQ = 3.25). Given the lack of guideline toxicity data for the major degradates, a chronic risk concern for fish cannot be precluded for the proposed use.

ECOSAR estimates suggest that both degradates are not more toxic than difenoconazole and are potentially less toxic. There would not be a chronic risk concern for fish if the degradates are less toxic than difenoconazole (RQ = 0.89 based on a 60-day difenoconazole-only EEC = 0.77 µg/L); therefore, guideline chronic fish studies with the major degradates (1,2,4-triazole and triazole acetic acid) would be useful for refining the risk conclusions if they demonstrate less toxicity than difenoconazole.

Table 13. Acute Risk Quotients for Freshwater and Estuarine/Marine Fish Exposed from the Proposed Difenoconazole Use (Difenoconazole EEC)

Peak EEC (µg/L)	Freshwater Acute RQ (LC ₅₀ = 810 µg/L)	Estuarine/Marine Acute RQ (LC ₅₀ = 819 µg/L)
1	< 0.01	< 0.01

Table 14. Chronic Risk Quotients for Freshwater and Estuarine/Marine Fish Exposed from the Proposed Difenoconazole Use (TTR EEC)

60-day EEC (µg/L)	Freshwater and Estuarine/Marine Chronic RQ (NOAEC = 0.86 µg/L)
2.8	3.25

BOLD exceeds chronic LOC (1.0).

8.2.2 Aquatic Invertebrates

There is not an acute risk concern for aquatic invertebrates from the proposed use. The acute listed-species LOC (0.05) was not exceeded for freshwater or estuarine/marine aquatic invertebrates (RQs < 0.01).

The chronic LOC (1.0) was not exceeded for freshwater invertebrates (RQ = 0.52); however, the LOC was exceeded for estuarine/marine invertebrates (RQ > 25.6). There is a chronic risk concern for aquatic invertebrates (listed and non-listed estuarine/marine species) from the proposed use.

Risk to benthic invertebrates was considered given the fate properties of difenoconazole. Risk was not assessed using the submitted chronic toxicity range-finding study (MRID 47648601) due to problems with the study design. Instead, risk to benthic invertebrates was considered using water column invertebrate data (*Daphnia* and *Americamysis*) as surrogates. Pore water difenoconazole concentrations were determined using PRZM/EXAMS¹² (see **Appendix 2**) and are similar to water column concentrations. Given the similar EECs, risk conclusions for benthic invertebrates are the same as those for water column invertebrates; that is, there is a risk concern for benthic estuarine/marine invertebrates but not a risk concern for benthic freshwater invertebrates. The risk concern triggered for water column estuarine/marine species (**Table 16**) is protective of estuarine/marine invertebrate species in general (i.e., there is a risk concern); however, the magnitude of the RQ associated with that concern is uncertain for both water column invertebrates (non-definitive endpoint) and benthic invertebrates (lack of data). There is more uncertainty in the risk conclusions for freshwater invertebrates given that benthic species may be more sensitive than water column species.

Table 15. Acute Risk Quotients for Freshwater and Estuarine/Marine Invertebrates Exposed from the Proposed Difenoconazole Use (Difenoconazole EEC)

Peak EEC (µg/L)	Freshwater Acute RQ (LC ₅₀ = 770 µg/L)	Estuarine/Marine Acute RQ (LC ₅₀ = 150 µg/L)
1	< 0.01	< 0.01

Table 16. Chronic Risk Quotients for Freshwater and Estuarine/Marine Invertebrates Exposed from the Proposed Difenoconazole Use (TTR EEC)

21-day EEC (µg/L)	Freshwater Chronic RQ (NOAEC = 5.6 µg/L)	Estuarine/Marine Chronic RQ (NOAEC <0.115 µg/L)
2.95	0.52	>25.6

BOLD exceeds chronic LOC (1.0).

¹² GENNEC currently does not provide porewater concentrations; therefore, difenoconazole-only EECs were calculated instead of TTR EECs for considering risk to benthic invertebrates.

8.2.3 Aquatic Plants

There is not a risk concern for aquatic plants from the proposed use based on available information. There were no LOC exceedances for listed or non-listed species (**Table 17**). There is some uncertainty about risk to non-vascular aquatic plants because an acceptable study with blue green algae is not available. There are not currently any listed non-vascular plants so the uncertainty is for non-listed species. Blue-green algae would need to be about 33x more sensitive than *Navicula pelliculosa* to exceed the LOC (non-listed species).

Table 17. Risk Quotients for Aquatic Plants Exposed to Difenconazole from the Proposed Difenconazole Use (TTR EEC)

Peak EEC (µg/L)	Vascular Plant Non-listed RQ (EC ₅₀ = 1900 µg/L)	Vascular Plant Listed RQ (EC ₀₅ = 110 µg/L)	Non-vascular Plant Non-listed RQ (EC ₅₀ = 98 µg/L)	Non-vascular Plant Listed RQ (NOAEC = 53 µg/L)
3.03	0.0016	0.0275	0.0309	0.0572

8.3 Risk Summary

The primary risk concerns from the proposed use are for chronically exposed listed and non-listed species of aquatic invertebrates (estuarine/marine), fish, birds, and mammals. In addition, a risk concern cannot be precluded for terrestrial dicots (listed species) based on the available data.

Appendix 1: TerrPlant Output

Table 1. Chemical Identity.	
Chemical Name	Difenoconazole
PC code	
Use	Canola
Application Method	Aerial
Application Form	
Solubility in Water (ppm)	15

Table 2. Input parameters used to derive EECs.			
Input Parameter	Symbol	Value	Units
Application Rate	A	0.113	
Incorporation	I	1	none
Runoff Fraction	R	0.02	none
Drift Fraction	D	0.05	none

Table 3. EECs for Difenoconazole. Units in .		
Description	Equation	EEC
Runoff to dry areas	$(A/I)*R$	0.00226
Runoff to semi-aquatic areas	$(A/I)*R*10$	0.0226
Spray drift	$A*D$	0.00565
Total for dry areas	$((A/I)*R)+(A*D)$	0.00791
Total for semi-aquatic areas	$((A/I)*R*10)+(A*D)$	0.02825

Table 4. Plant survival and growth data used for RQ derivation. Units are in .				
Plant type	Seedling Emergence		Vegetative Vigor	
	EC25	NOAEC	EC25	NOAEC
Monocot	0.111	0.111	0.123	0.123
Dicot			0.123	0.123

Table 5. RQ values for plants in dry and semi-aquatic areas exposed to Difenoconazole through runoff and/or spray drift.*				
Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
Monocot	non-listed	<0.1	0.25	<0.1
Monocot	listed	<0.1	0.25	<0.1
Dicot	non-listed	#DIV/0!	#DIV/0!	<0.1
Dicot	listed	#DIV/0!	#DIV/0!	#DIV/0!

*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.

Appendix 2: PRZM/EXAMS and GENEEC Outputs

Example Output of PRZM/EXAMS for Surface water (Aerial Application)

stored as NDConla_E_A.out

Chemical: Difenconazole

PRZM environment: NDcanolaSTD.txt, modified Tuesday, 29 May 2007 at 13:59:22

EXAMS environment: pond298.exv, modified Tuesday, 26 August 2008 at 06:14:08

Metfile: w24013.dvf, modified Tuesday, 26 August 2008 at 06:15:40

Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.31	0.26	0.15	0.08	0.07	0.02
1962	0.36	0.31	0.19	0.13	0.11	0.07
1963	0.42	0.36	0.28	0.21	0.19	0.13
1964	0.49	0.44	0.34	0.29	0.28	0.21
1965	0.56	0.51	0.41	0.34	0.32	0.28
1966	0.60	0.55	0.43	0.37	0.36	0.31
1967	0.64	0.59	0.47	0.40	0.39	0.35
1968	0.66	0.61	0.49	0.45	0.44	0.38
1969	0.70	0.65	0.53	0.46	0.44	0.41
1970	0.78	0.72	0.63	0.54	0.52	0.45
1971	0.93	0.86	0.71	0.63	0.61	0.52
1972	0.85	0.79	0.68	0.61	0.59	0.56
1973	0.84	0.79	0.68	0.62	0.61	0.56
1974	0.86	0.81	0.69	0.62	0.61	0.57
1975	0.88	0.83	0.72	0.65	0.65	0.60
1976	0.90	0.85	0.73	0.66	0.64	0.61
1977	0.91	0.85	0.74	0.67	0.66	0.62
1978	0.93	0.88	0.76	0.70	0.69	0.65
1979	0.97	0.91	0.79	0.72	0.70	0.67
1980	0.94	0.88	0.76	0.73	0.72	0.67
1981	0.96	0.92	0.81	0.73	0.71	0.68
1982	0.97	0.91	0.79	0.72	0.72	0.68
1983	0.97	0.92	0.80	0.73	0.73	0.70
1984	0.99	0.94	0.82	0.75	0.73	0.71
1985	0.99	0.93	0.82	0.77	0.75	0.71
1986	0.99	0.94	0.82	0.75	0.73	0.71
1987	1.27	1.17	0.97	0.88	0.85	0.74
1988	1.04	0.98	0.86	0.79	0.77	0.75

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
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0.03	1.27	1.17	0.97	0.88	0.85	0.75
0.07	1.04	0.98	0.86	0.79	0.77	0.74
0.10	0.99	0.94	0.82	0.77	0.75	0.71
0.14	0.99	0.94	0.82	0.75	0.73	0.71
0.17	0.99	0.93	0.82	0.75	0.73	0.71
0.21	0.97	0.92	0.81	0.73	0.73	0.70
0.24	0.97	0.92	0.80	0.73	0.72	0.68
0.28	0.97	0.91	0.79	0.73	0.72	0.68
0.31	0.96	0.91	0.79	0.72	0.71	0.67
0.34	0.94	0.88	0.76	0.72	0.70	0.67
0.38	0.93	0.88	0.76	0.70	0.69	0.65
0.41	0.93	0.86	0.74	0.67	0.66	0.62
0.45	0.91	0.85	0.73	0.66	0.65	0.61
0.48	0.90	0.85	0.72	0.65	0.64	0.60
0.52	0.88	0.83	0.71	0.63	0.61	0.57
0.55	0.86	0.81	0.69	0.62	0.61	0.56
0.59	0.85	0.79	0.68	0.62	0.61	0.56
0.62	0.84	0.79	0.68	0.61	0.59	0.52
0.66	0.78	0.72	0.63	0.54	0.52	0.45
0.69	0.70	0.65	0.53	0.46	0.44	0.41
0.72	0.66	0.61	0.49	0.45	0.44	0.38
0.76	0.64	0.59	0.47	0.40	0.39	0.35
0.79	0.60	0.55	0.43	0.37	0.36	0.31
0.83	0.56	0.51	0.41	0.34	0.32	0.28
0.86	0.49	0.44	0.34	0.29	0.28	0.21
0.90	0.42	0.36	0.28	0.21	0.19	0.13
0.93	0.36	0.31	0.19	0.13	0.11	0.07
0.97	0.31	0.26	0.15	0.08	0.07	0.02
0.10	1.00	0.95	0.83	0.77	0.75	0.71
					Average of yearly averages:	0.51

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:

Output File: NDConla_E_A

Metfile: w24013.dvf

PRZM NDcanolaSTD.txt

scenario:

EXAMS pond298.exv

environm

ent file:

Chemical Difenconazole

Name:

Descripti	Variable	Value	Units	Comments
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on	Name			
Molecular weight	mwt	406.27	g/mol	
Henry's Law Const.	henry	8.90E-12	atm-m ³ /mol	
Vapor Pressure	vapr	2.50E-10	torr	
Solubility	sol	15	mg/L	
Kd	Kd		mg/L	
Koc	Koc	5381	mg/L	
Photolysis half-life	kdp	0	days	Half-life
Aerobic Aquatic Metabolism	kbacw	556	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1110	days	Halfife
Aerobic Soil Metabolism	asm	313	days	Halfife
Hydrolysis:	pH 7	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation	DEPI		cm	
Depth:				
Application Rate:	TAPP	0.127	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	
Application Date	Date	18-07	dd/mm or dd/mm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0.5		
Flag for Index Res. Run	IR	EPA Pond		
Flag for runoff	RUNOFF	none	none, monthly or total(average of entire run)	

calc.

Example Output of PRZM/EXAMS for Porewater (Aerial Application)

stored as NDConla_E_Aben.out

Chemical: Difenconazole

PRZM environment: NDcanolaSTD.txt, modified Tuesday, 29 May 2007 at 13:59:22

EXAMS environment: pond298.exv, modified Tuesday, 26 August 2008 at 06:14:08

Metfile: w24013.dvf, modified Tuesday, 26 August 2008 at 06:15:40

Benthic segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.04	0.04	0.04	0.04	0.04	0.02
1962	0.08	0.08	0.08	0.08	0.08	0.06
1963	0.15	0.15	0.15	0.15	0.15	0.11
1964	0.24	0.24	0.24	0.24	0.24	0.19
1965	0.28	0.28	0.28	0.28	0.28	0.25
1966	0.31	0.31	0.31	0.31	0.31	0.29
1967	0.34	0.34	0.34	0.34	0.34	0.32
1968	0.38	0.38	0.38	0.38	0.38	0.35
1969	0.40	0.40	0.40	0.40	0.40	0.38
1970	0.45	0.45	0.45	0.45	0.45	0.42
1971	0.54	0.54	0.54	0.54	0.54	0.47
1972	0.54	0.54	0.54	0.54	0.54	0.53
1973	0.55	0.55	0.55	0.55	0.54	0.53
1974	0.55	0.55	0.55	0.55	0.55	0.54
1975	0.59	0.59	0.59	0.59	0.58	0.56
1976	0.59	0.59	0.59	0.59	0.58	0.58
1977	0.60	0.60	0.60	0.60	0.60	0.58
1978	0.62	0.62	0.62	0.62	0.62	0.61
1979	0.64	0.64	0.64	0.64	0.64	0.62
1980	0.65	0.65	0.65	0.65	0.65	0.63
1981	0.65	0.65	0.65	0.65	0.65	0.64
1982	0.66	0.66	0.66	0.66	0.66	0.64
1983	0.67	0.67	0.67	0.67	0.67	0.65
1984	0.68	0.68	0.68	0.67	0.67	0.66
1985	0.68	0.68	0.68	0.68	0.68	0.66
1986	0.68	0.68	0.68	0.67	0.67	0.67
1987	0.75	0.75	0.75	0.74	0.74	0.68
1988	0.73	0.73	0.73	0.73	0.73	0.71

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.75	0.75	0.75	0.74	0.74	0.71
0.07	0.73	0.73	0.73	0.73	0.73	0.68

0.10	0.68	0.68	0.68	0.68	0.68	0.67
0.14	0.68	0.68	0.68	0.67	0.67	0.66
0.17	0.68	0.68	0.68	0.67	0.67	0.66
0.21	0.67	0.67	0.67	0.67	0.67	0.65
0.24	0.66	0.66	0.66	0.66	0.66	0.64
0.28	0.65	0.65	0.65	0.65	0.65	0.64
0.31	0.65	0.65	0.65	0.65	0.65	0.63
0.34	0.64	0.64	0.64	0.64	0.64	0.62
0.38	0.62	0.62	0.62	0.62	0.62	0.61
0.41	0.60	0.60	0.60	0.60	0.60	0.58
0.45	0.59	0.59	0.59	0.59	0.58	0.58
0.48	0.59	0.59	0.59	0.59	0.58	0.56
0.52	0.55	0.55	0.55	0.55	0.55	0.54
0.55	0.55	0.55	0.55	0.55	0.54	0.53
0.59	0.54	0.54	0.54	0.54	0.54	0.53
0.62	0.54	0.54	0.54	0.54	0.54	0.47
0.66	0.45	0.45	0.45	0.45	0.45	0.42
0.69	0.40	0.40	0.40	0.40	0.40	0.38
0.72	0.38	0.38	0.38	0.38	0.38	0.35
0.76	0.34	0.34	0.34	0.34	0.34	0.32
0.79	0.31	0.31	0.31	0.31	0.31	0.29
0.83	0.28	0.28	0.28	0.28	0.28	0.25
0.86	0.24	0.24	0.24	0.24	0.24	0.19
0.90	0.15	0.15	0.15	0.15	0.15	0.11
0.93	0.08	0.08	0.08	0.08	0.08	0.06
0.97	0.04	0.04	0.04	0.04	0.04	0.02
0.10	0.69	0.69	0.69	0.69	0.68	0.67
					Average of yearly averages:	0.48

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:

Output File: NDConla_E_A

Metfile: w24013.dvf

PRZM NDcanolaSTD.txt

scenario:

EXAMS pond298.exv

environm

ent file:

Chemical Difenconazole

Name:

Descripti	Variable	Value	Units	Comments
on	Name			
Molecula	mwt	406.27	g/mol	

r weight				
Henry's Law Const.	henry	8.90E-12	atm-m ³ /mol	
Vapor Pressure	vapr	2.50E-10	torr	
Solubility	sol	15	mg/L	
Kd	Kd		mg/L	
Koc	Koc	5381	mg/L	
Photolysis half-life	kdp	0	days	Half-life
Aerobic Aquatic Metabolism	kbacw	556	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1110	days	Halfife
Aerobic Soil Metabolism	asm	313	days	Halfife
Hydrolysis:	pH 7	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI		cm	
Application Rate:	TAPP	0.127	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	
Application Date	Date	18-07	dd/mm or dd/mm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0.5		
Flag for Index Res. Run	IR	EPA Pond		
Flag for runoff calc.	RUNOFF	none	none, monthly or total(average of entire run)	

Example Output of GENEEC

Aerial Application

```

RUN No.    1 FOR Difenconazole    ON    Oilseed    * INPUT VALUES *
-----
RATE (#/AC)  No.APPS &  SOIL  SOLUBIL  APPL TYPE NO-SPRAY INCORP
ONE(MULT)   INTERVAL   Koc  (PPM )  (%DRIFT)  (FT)    (IN)
-----
.113(  .113)  1  1    1000.0   15.0   AERL_B( 13.0)    .0    .0
FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
-----
METABOLIC  DAYS UNTIL  HYDROLYSIS  PHOTOLYSIS  METABOLIC  COMBINED
(FIELD)    RAIN/RUNOFF  (POND)      (POND-EFF)  (POND)     (POND)
-----
.00        2          N/A          .00-        .00        .00        .00
GENERIC EECs (IN MICROGRAMS/LITER (PPB))    Version 2.0 Aug 1, 2001
-----
PEAK        MAX 4 DAY    MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
GEEC        AVG GEEC     AVG GEEC     AVG GEEC     AVG GEEC
-----
3.03        3.01        2.95        2.80        2.70

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Ground Application

```

RUN No.    2 FOR Difenconazole    ON    Canola    * INPUT VALUES *
-----
RATE (#/AC)  No.APPS &  SOIL  SOLUBIL  APPL TYPE NO-SPRAY INCORP
ONE(MULT)   INTERVAL   Koc  (PPM )  (%DRIFT)  (FT)    (IN)
-----
.113(  .113)  1  1    1000.0   15.0   GRHIFI( 6.6)    .0    .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
-----
METABOLIC  DAYS UNTIL  HYDROLYSIS  PHOTOLYSIS  METABOLIC  COMBINED
(FIELD)    RAIN/RUNOFF  (POND)      (POND-EFF)  (POND)     (POND)
-----
.00        2          N/A          .00-        .00        .00        .00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))    Version 2.0 Aug 1, 2001
-----
PEAK        MAX 4 DAY    MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
GEEC        AVG GEEC     AVG GEEC     AVG GEEC     AVG GEEC
-----
2.74        2.73        2.67        2.53        2.44

```

